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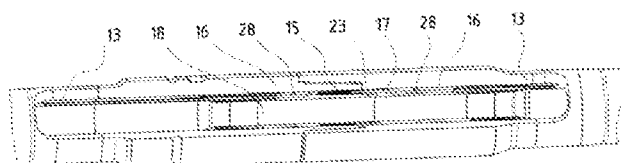
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(54) Title **INSTALLATION KIT, DRILL PIPE, DRILL STRING AND METHOD FOR PRODUCING OR REWORKING A DRILL PIPE OF A DRILL STRING**

(57) Abstract

Installation kit for drill pipes (6) of a string of pipes, in particular of a drill string, having a first end (17) and a second end (18), which are connected to one another by means of at least one connecting line (13). One of the two ends (18) is arranged in a pin (3) of the drill pipe (6) and the other end (17) is arranged in a box (1) of the drill pipe (6). Arranged at the first end (17) and/or the second end (18) is a seal (23), which seals the first end (17) in relation to the second end (18) of an installation kit (7) which is to be connected, and arranged on the circumferential surface (11) of each end (17, 18) is a sealing element (20), which seals the respective end (17, 18) in relation to the pin (3) or the box (1).



The invention relates to an installation kit for hollow rods of a pipe string, in particular a drill string; a hollow rod of a pipe string, in particular a drill string; a pipe string, in particular a drill string; and a method for producing or reworking a hollow rod.

5 An essential element in modern drilling processes, in particular in crude oil, natural gas, and geothermal energy drilling, is the data acquisition and the control of various modules of the drill string during the drilling operation, as well as the power supply of electrical modules in the drill string. The same also applies, however, for the subsequent crude oil, gas, or hot water production, to which the invention also
10 relates. The drilling industry therefore requires a system that makes it possible to transfer energy electrically and/or to transmit data electrically or optically during the drilling process or production process.

Such a system should in this case be as independent as possible of the structural design of the hollow rods, so that both new hollow rods and already present hollow
15 rods can be outfitted using it.

This object is achieved according to the invention with an installation kit with the features of Claim 1.

This object is achieved in addition with a hollow rod with the features of Claim 13 and with a pipe string, in particular a drill string, with the features of Claim 16.

20 The installation kit according to the invention has a first end and a second end, which are connected to one another by means of at least one connecting line. One of the two ends is arranged in a pin of the hollow rod, and the other end is arranged in a box of the hollow rod. A seal is arranged on the first end and/or on the second end in order to seal one end of an installation kit in a hollow rod relative
25 to the other end of an installation kit that is to be connected. Finally, a sealing element that seals the respective end relative to the pin or the box is arranged on the peripheral surface of each end. Thus, it is possible to outfit or to retrofit hollow rods of generally any design in such a way that an electrical, optical, and/or hydraulic data and/or supply line can be incorporated, which line is largely
30 independent of the actual hollow rod. That is to say that the hollow rods and their connections to attached hollow rods via a pin and a box do not need to be changed when they are outfitted or retrofitted with an installation kit according to the invention.

As claimed by the method according to the invention in accordance with Claim 19, it is only necessary to provide a suitable receptacle inside the pin and the box in a new or an already present old hollow rod by machining the inside surface of the pipe in this area so that the two ends of the installation kit can be accommodated in a reliable and tight manner.

All seals, sealing elements, and packings according to the invention are designed in such a way that they correspond to the safety instructions in connection with electrical current to drilling rigs, and thus no further safety measures need to be concerned.

Additional preferred embodiments of the invention are the subject matter of the subclaims.

The connecting line between the two ends could, according to the invention, already itself be a correspondingly protected electrical, optical, or hydraulic line, but it is preferably a pipe in which an electrical or optical line is or can be accommodated. Of course, empty piping is also possible.

The connecting line, and in particular the pipe, is connected in another preferred embodiment of the invention to both ends at respectively one duct in the ends. Thus, the connecting line or the electrical or optical line arranged in the connecting line can be run securely to a connecting point between the interconnecting ends of the installation kit or hollow rods.

In particular, it is preferred in the invention when one end of the installation kit has a pipe coupling and the other end has a spigot end, and a seal is arranged between the pipe coupling and the spigot end. By the cogging of pipe coupling and spigot end, a mechanically stable connection, on the one hand, and a very reliable packing of the two ends that are to be connected to one another, on the other hand, are ensured.

In this case, in a preferred embodiment of the invention, the spigot end can have a first longitudinal section and a second longitudinal section, wherein the first longitudinal section has a larger outside diameter than the second longitudinal section; wherein the at least one connecting line on the first longitudinal section is connected to the duct; and wherein the duct empties onto a shoulder between the first and second longitudinal sections.

In another preferred embodiment of the invention, the duct empties onto a front side of the pipe coupling, and the at least one connecting line is connected to the duct on a side of the pipe coupling that is opposite to the front side.

5 These two embodiments of the invention can be combined with one another, at which point the additional possibility according to the invention is offered that the front side of the pipe coupling and the shoulder are separated from one another.

The thus-formed space between the spigot end, the pipe coupling, and a hollow rod can be used for accommodating at least one electrical, optical, hydraulic, or radio system. In particular, in this space, electrical and/or optical systems, such as
10 measuring systems, as well as connections or couplings can be incorporated for connecting the electrical and/or optical lines from one installation kit to the next.

Additional features and advantages of the invention follow from the subsequent description of a preferred embodiment of the invention that does not limit the scope of protection with reference to the accompanying drawings. Here:

15 Fig. 1 shows a hollow rod,

Fig. 2 shows an embodiment of an installation kit according to the invention,

Fig. 3 shows the ends of the installation kit of Fig. 2 on an enlarged scale and in section,

20 Fig. 4 shows the installation kit according to Fig. 2, incorporated into the hollow rod of

Fig. 1, in a partial longitudinal section,

Fig. 5 shows the incorporated installation kit of Fig. 4 with additional details, and

Fig. 6 shows the connecting area of two hollow rods of a drill string with an installation kit according to the invention in a partial section.

25 In the drawings, an embodiment of an installation kit according to the invention is depicted, which installation kit, however, is intended only as an example, and aside from the features according to the invention as defined in the claims, can also be

implemented differently within the scope of this invention as regards many components, without this requiring special mention below.

In Fig. 1, an embodiment of a hollow rod 6 that is common per se in the state of the art is depicted with adjustments according to the invention. It is understood
 5 that the hollow rod can also be designed differently if specific features of the hollow rod 6 are not specified below as absolutely necessary features.

In the depicted embodiment, the hollow rod 6 has a pipe body 2, on one end of which is arranged a pin 3 and on the other end of which is arranged a box 1. Preferably, but not necessarily, the box 1 and the pin 3 are welded onto the pipe
 10 body 2. An outside thread or threaded connection is attached to the pin 3, and an inside thread or pipe coupling thread is attached in the box 1, wherein the two threads are preferably taper threads. By screwing the threaded connection on the pin 3 into the pipe coupling thread in the box 1, multiple hollow rods 6 can be
 15 joined together to form a drill string, wherein this connection provides a sufficiently reliable packing between the interior and exterior of the drill string.

The hollow rod 6 is open end-to-end in its interior, so that a channel 8 is produced in the hollow rods 6 that are screwed onto one another, by which channel, e.g., drilling fluid can be conveyed from the drilling rig to the surface of the drill head. If
 20 the hollow rod 6 is not a drill string, but rather a pipe string for the conveying of, for example, oil, gas, or water, the latter can be conveyed upward through the channel 8 into the interior of the hollow rods 6.

In the depicted embodiment, cylindrical holes 4, 5 are preferably located in the area of the box 1 and the pin 3, into which holes a first end 17 and a second end 18 of an installation kit 7 according to the invention are inserted.

25 In the installation kit 7 according to the invention, depicted in the drawings, the two ends 17, 18 are connected by means of two connecting lines 13. Of course, more than two connecting lines or only a single connecting line can also be present. The connecting lines 13 are tightly connected, for example by means of a seal 37, to ducts 16 in the ends 17, 18.

30 On the side opposite to the connecting lines 13, the one end 17 has a pipe coupling 19, and the other end 18 has a spigot end 20. The pipe coupling 19 and the spigot end 20 are compatible and can be plugged into one another, so that a connection

between two interconnecting installation kits 7 can be produced. In order to be able to produce a tight connection between the pipe coupling 19 and the spigot end 20, the pipe coupling 19 has an inside wall area 21, and the spigot end 20 has an outside wall area 22. The inside wall area 21 and the outside wall area 22 are preferably cylindrical, but can also be conical or concave/convex. A sealing ring 23 is arranged on the outside wall area 22 of the spigot end 20. When the pipe coupling 19 and the spigot end 20 are plugged together, a tight connection of an installation kit 7 with a connecting installation kit 7 is produced via the sealing ring 23.

Alternatively, it is also possible in the invention, however, that the seal is not a separate part, such as a sealing ring, but rather is formed by two sealing surfaces arranged on the pipe coupling 19 and on the spigot end 20, which sealing surfaces are adjacent under pressure, causing the seal to be produced by the sealing surfaces on the pipe coupling 19 and the spigot end 20.

In the pipe coupling 19, the duct 16 runs from the connecting line 13 through the interior of the pipe coupling 19 up to a front side 24, which is opposite to the connecting line 13.

The spigot end 20 has a first longitudinal section 25 and a second longitudinal section 26, which both have an essentially cylindrical shape. The first longitudinal section 25 has a larger outside diameter than the second longitudinal section 26. A shoulder 27 is formed at the transition between the first longitudinal section 25 and the second longitudinal section 26. In the spigot end 20, the duct 16 runs from the connecting line 13 through the interior of the spigot end 20 up to the shoulder 27 and empties there.

The distances between the emptying point of the duct 16 and the front side 24 of the pipe coupling 19 and between the emptying point of the duct 16 and the shoulder 27 of the spigot end 20 of a longitudinal axis of the installation kit 7 are preferably essentially the same, wherein different distances are, of course, also possible, however.

In the depicted embodiment of the installation kit 7 according to the invention, the shoulder 27 of the spigot end 20 and the front side 24 of the pipe coupling 19 are located at a distance that is great enough to form a space 15, in which electrical and/or optical components can be arranged. These components can be, for

example, sensors and electrical or electromagnetic connections or couplings, via which energy can be transferred electrically and/or data can be transmitted electrically or optically when the pipe coupling 19 and the spigot end 20 are plugged together.

5 For example, the device, described in EP 2 440 737 B1, for connecting electrical lines can be incorporated into the space 15, in order to connect to one another electrical lines of interconnecting hollow rods 6 or installation kits 7 that run through the connecting lines 13 and the ducts 16.

10 The sealing of the ends 17, 18 to the hollow rod 6 is ensured by sealing sleeves 9, 14, which are integrated in the pipe coupling 19 and the spigot end 20 or are connected tightly to the latter. The sealing sleeves 9, 14 have a peripheral surface 11 with a cylindrical shape, on which a sealing element 28 is arranged.

15 In order to fasten the ends 17, 18 in the pin 3 and in the box 1, a clamping device 29 is provided, which device consists essentially of two sleeves 10, 12, which can be moved relative to one another in the axial direction. Each of the sleeves 10, 12 has a wedge surface 31, 32 on the side facing the other sleeve 10, 12. Between the two sleeves 10, 12, wedges 33, which have wedge surfaces assigned to the wedge surfaces 31, 32, are arranged uniformly distributed around the periphery. The sleeves 10, 12 can be tightly braced against one another by means of screws 34, causing the wedges 33 to be moved radially outward and the clamping device 29 in each case to be clamped in the pin 3 and in the box 1. The clamping devices 29, more precisely their sleeves 10 arranged on the side of the pipe coupling 19 or the spigot end 20, have, in addition, spring projections 35, which can lock in recesses 36 in the pipe coupling 19 or the spigot end 20.

25 The mounting of an installation kit 7 according to the invention can, for example, be carried out so that first, in each case, a clamping device 29 is inserted into the pin 3 and the box 1 of a hollow rod 6. In this case, the connecting lines 13 are inserted far enough into the holes 38, 39 that are provided in the sleeves 10, 12 to cause them to extend beyond the sleeve 10. If necessary, the clamping devices 29 are then pulled somewhat apart again in order to clamp the connecting lines 13.

30 Then, the screws 34 are tightened, causing the sleeves 10, 12 to be moved toward one another and the wedges 33 to be pressed radially outward until the clamping devices 29 are fixed in the pin 3 and in the box 1.

Subsequently, the electrical and/or optical lines can be pushed through the connecting lines 13 and the ducts 16 in the prepared pipe coupling 19 and the spigot end 20. Then, the pipe coupling 19 and the spigot end 20 are inserted into the pin 3 and the pipe coupling 1 until the projections 35 lock in the recesses 36, at
 5 which point the two ends 17, 18 are mounted securely in the hollow rod 6.

When the two ends 17, 18 are fastened in the pin 3 and the box 1 in the way depicted in the figures and described above, the space 15 is sealed with respect to the environment, i.e., in the area outside of the hollow rod 6, on the one hand, and the channel 8 in the interior of the hollow rod 6, on the other hand, but remains
 10 open to the ducts 16 by the seal 23 between the pipe coupling 19 and the spigot end 20, the sealing elements 28 between the peripheral surface 11 of each end 17, 18, and the pin 3 and the box 1, as well as the packing on interconnecting hollow rods 6 in the screw connection between the pin 3 and the box 1. Since the ducts 16 in turn are well sealed relative to the connecting line(s) 13, no critical connection or
 15 leak relative to the environment even exists here, either.

With the installation kit according to the invention, a system solution that is largely independent of the geometry of the hollow rods 6 can be provided in a simple way, with which hollow rods 6 can be supplemented by the possibility of having a tight and thus more reliable option for laying electrical and optical lines.

20 The installation kit according to the invention can be used not only in the production of new hollow rods, but also for retrofitting older hollow rods that have already been in operation for an extended period.

In this case, it is only necessary to process an inside surface of the pipe in the pin 3 and in the box 1 and to produce cylindrical holes 4, 5, into which the two ends 17, 18 of the installation kit 7 fit exactly. Since, in this case, this is a relatively simple
 25 processing step, the latter can be performed not only in workshops that are well outfitted for this purpose but also on a drilling rig on site.

With the installation kit 7 according to the invention, it is also possible in addition to rework the thread on the pin 3 and in the box 1, which is necessary at regular
 30 intervals because of wear and tear or damage to the thread. In this case, it is only necessary to remove the installation kit 7 from a hollow rod 6, to rework the thread, and to insert the installation kit 7 again into the hollow rod 6. A shortening of the connecting line 13 between the two ends 17, 18, which is necessary in any

case because of the shortening of the length of the hollow rod 6, can also be easily implemented.

Thus, the reworking of the thread of hollow rods 6 can also be implemented in a simple way on site.

5 Reference Symbol List:

	1	Box
	2	Pipe body
	3	Pin
	4	Cylindrical hole
10	5	Cylindrical hole
	6	Hollow rod
	7	Installation kit
	8	Channel
	9	Sealing sleeve
15	10	Sleeve
	11	Peripheral surface
	12	Sleeve
	13	Connecting line
	14	Sealing sleeve
20	15	Space
	16	Ducts
	17	End
	18	End
	19	Pipe coupling
25	20	Spigot end
	21	Inside wall area
	22	Outside wall area
	23	Sealing ring
	24	Front side
30	25	First longitudinal section
	26	Second longitudinal section
	27	Shoulder
	28	Sealing element
	29	Clamping device
35	30	–

	31	Wedge surface
	32	Partial [sic] surface
	33	Wedges
	34	Screws
5	35	Projections
	36	Recesses
	37	Seal
	38	Hole
	39	Hole

Claims:

1. Installation kit for hollow rods (6) of a pipe string, in particular a drill string, characterized in that it has a first end (17) and a second end (18), which are connected to one another by means of at least one connecting line (13); in that
5 each end (17, 18) has a peripheral surface (11); in that one of the two ends (18) can be arranged in a pin (3) of the hollow rod (6), and the other end (17) can be arranged in a box (1) of the hollow rod (6); in that a seal (23) is arranged on the first end (17) and/or on the second end (18), where the first end (17) of an installation kit (7) that is to be connected is sealed relative to the second end (18);
10 and in that a sealing element (28) that seals the respective end (17, 18) relative to the pin (3) or the box (1) is arranged on the peripheral surface (11) of each end (17, 18).

2. Installation kit according to Claim 1, characterized in that the at least one
15 connecting line (13) is connected to respectively one duct (16) in the ends (17, 18).

3. Installation kit according to Claim 2, characterized in that the connecting line (13) is accommodated to move in the duct (16) in the longitudinal direction via a seal (37).
20

4. Installation kit according to one of Claims 1 to 3, characterized in that one end (17) has a pipe coupling (19) and the other end (18) has a spigot end (20), and in that a seal (23) is arranged between the pipe coupling (19) and the spigot end (20).
25

5. Installation kit according to Claims 2 and 4, characterized in that the spigot end (20) has a first longitudinal section (25) and a second longitudinal section (26); in that the first longitudinal section (25) has a larger outside diameter than the second longitudinal section (26); in that the at least one connecting line (13) is
30 connected to the duct (16) on the first longitudinal section (25); and in that the duct (16) empties onto a shoulder (27) between the first longitudinal section (25) and the second longitudinal section (26).

6. Installation kit according to Claims 2 and 4 or 5, characterized in that the
35 duct (16) empties onto a front side (24) of the pipe coupling (19), and in that the at least one connecting line (13) is connected to the duct (16) on a side of the pipe coupling (19) that is opposite to the front side (24).

7. Installation kit according to Claims 5 and 6, characterized in that the front side (24) of the pipe coupling (19) and the shoulder (27) are separated from one another.

5

8. Installation kit according to one of Claims 1 to 7, characterized in that the peripheral surface (11) of at least one end (17, 18), preferably of both ends (17, 18), has a shape that is cylindrical at least in sections.

10

9. Installation kit according to Claim 8, characterized in that the peripheral surface (11) on the spigot end (20) and/or on the pipe coupling (19) is arranged on a sealing sleeve (9, 14) that in each case surrounds the spigot end (20) and the pipe coupling (19), on which sleeve the sealing element (28) is arranged.

15

10. Installation kit according to one of Claims 1 to 9, characterized in that at least one end (17, 18) is fastened preferably on both ends (17, 18) in the pin (3) or the box (1) by means of a clamping device (10, 12).

20

11. Installation kit according to Claim 10, characterized in that the clamping device has two sleeves (10, 12) that can move in the axial direction and that can be screwed against one another; in that a wedge surface (31, 32) is arranged on at least one of the sleeves (10, 12); and in that wedges (33) that can move in the radial direction on the wedge surface (31, 32) are arranged between the sleeves (10, 12).

25

12. Installation kit according to one of Claims 2 to 11, characterized in that at least one electrical, optical, or hydraulic line is arranged in the at least one connecting line (13) and the ducts (16), or in that the connecting line (13) is empty.

30

13. Hollow rod of a pipe string, in particular a drill string, with a pin (3) and a box (1) and a pipe body (2) arranged between the pin (3) and the box (1), characterized in that an installation kit (7) is arranged in the hollow rod (6) according to one of Claims 1 to 12.

35

14. Hollow rod according to Claim 13, characterized in that the pin (3) and the box (1) have cylindrical holes (4, 5), in which the ends (17, 18) of the installation kit (7) are accommodated.

15. Hollow rod according to Claim 13 or 14, characterized in that at least one sealing ring, preferably two or more sealing rings, are arranged on at least one end (17, 18), preferably on two ends (17, 18), of the installation kit (7) as a sealing element (28).

5

16. Pipe string, in particular drill string, with at least two hollow rods (6) that are connected to one another with a pin (3) and a box (1) and a pipe body (2) arranged between the pin (3) and the box (1), wherein the pin (3) and the box (1) of interconnecting hollow rods (6) are connected tightly to one another,
10 characterized in that the hollow rods (6) are designed according to one of Claims 13 to 15.

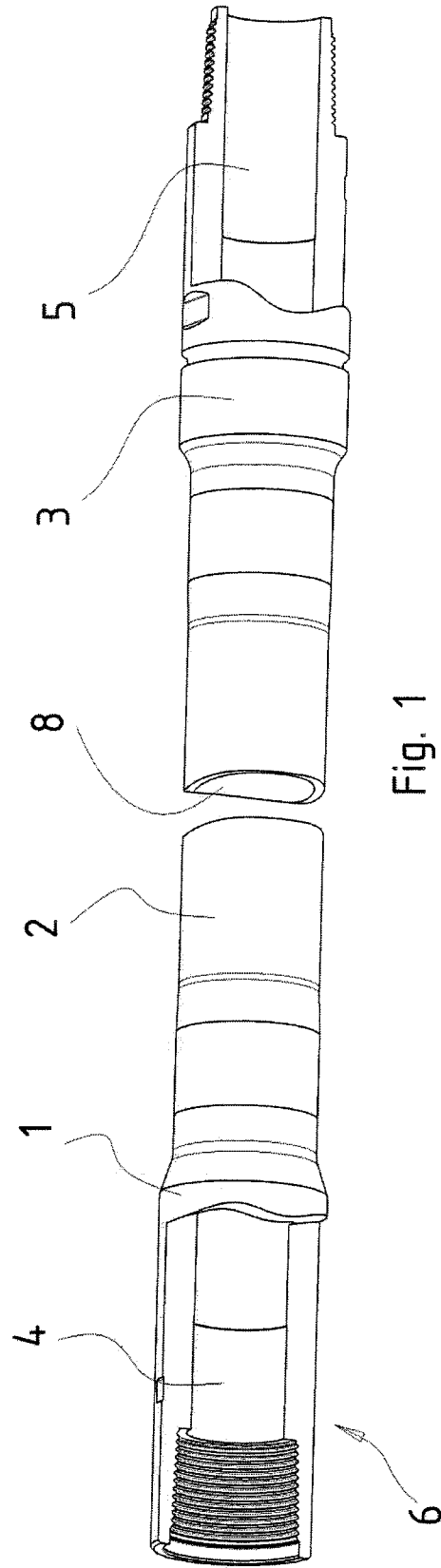
17. Pipe string according to Claim 16, characterized in that a space (15), preferably an annular space, is formed for accommodating at least one electrical,
15 electronic, or optical system between the spigot end (20), the pipe coupling (19), and a hollow rod (6).

18. Pipe string according to Claim 17, characterized in that the space (15) is sealed with respect to the environment, but remains open to the ducts (16), by the
20 seal (23) between the first end (17) and the second end (18), the sealing elements (28) between the peripheral surface (11) of each end (17, 18), and the pin (3) and the box (1), as well as the packing between the pin (3) and the box (1) of interconnecting hollow rods (6).

25 19. Method for producing or reworking a hollow rod (6) of a pipe string, in particular a drill string, with a pin (3) and a box (1) and a pipe body (2) arranged between the pin (3) and the box (1), characterized in that an inside surface of a pipe is machined in the pin (3) and in the box (1), and in that then the installation kit (7) is incorporated into the hollow rod (6) according to one of Claims 1 to 12.

30

20. Method according to Claim 19, characterized in that the pin (3) and the box (1) have a thread; in that the thread is reworked; in that optionally the length of the connecting line (13) is adapted to the length of the hollow rod (6) that is shortened by the reworking; and in that then the installation kit (7) is incorporated
35 into the hollow rod (6).



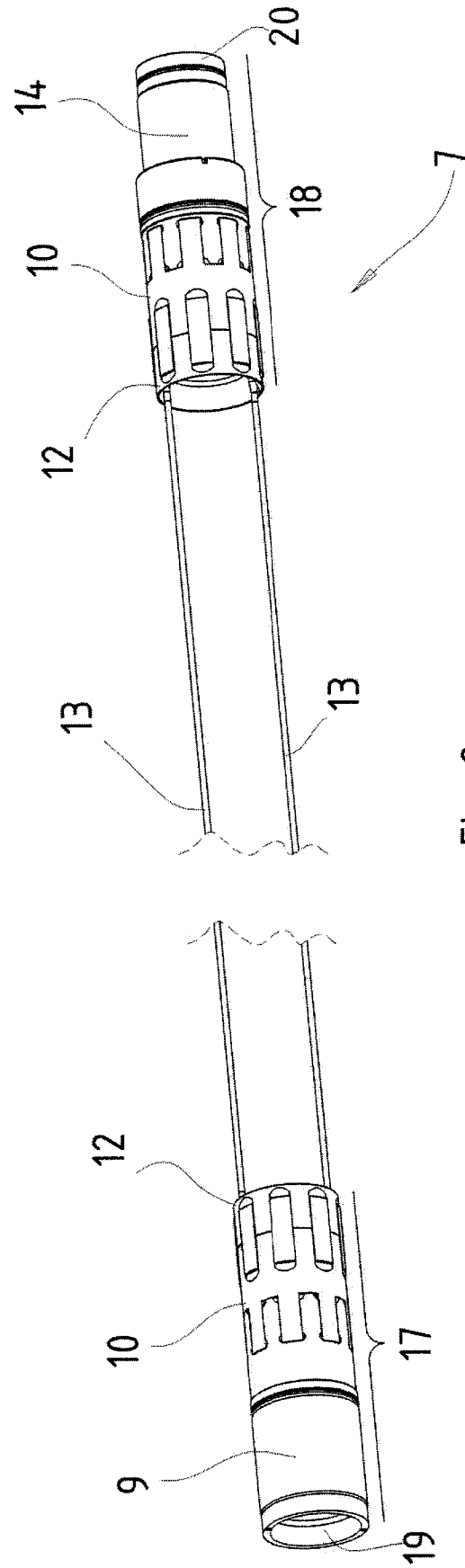


Fig. 2

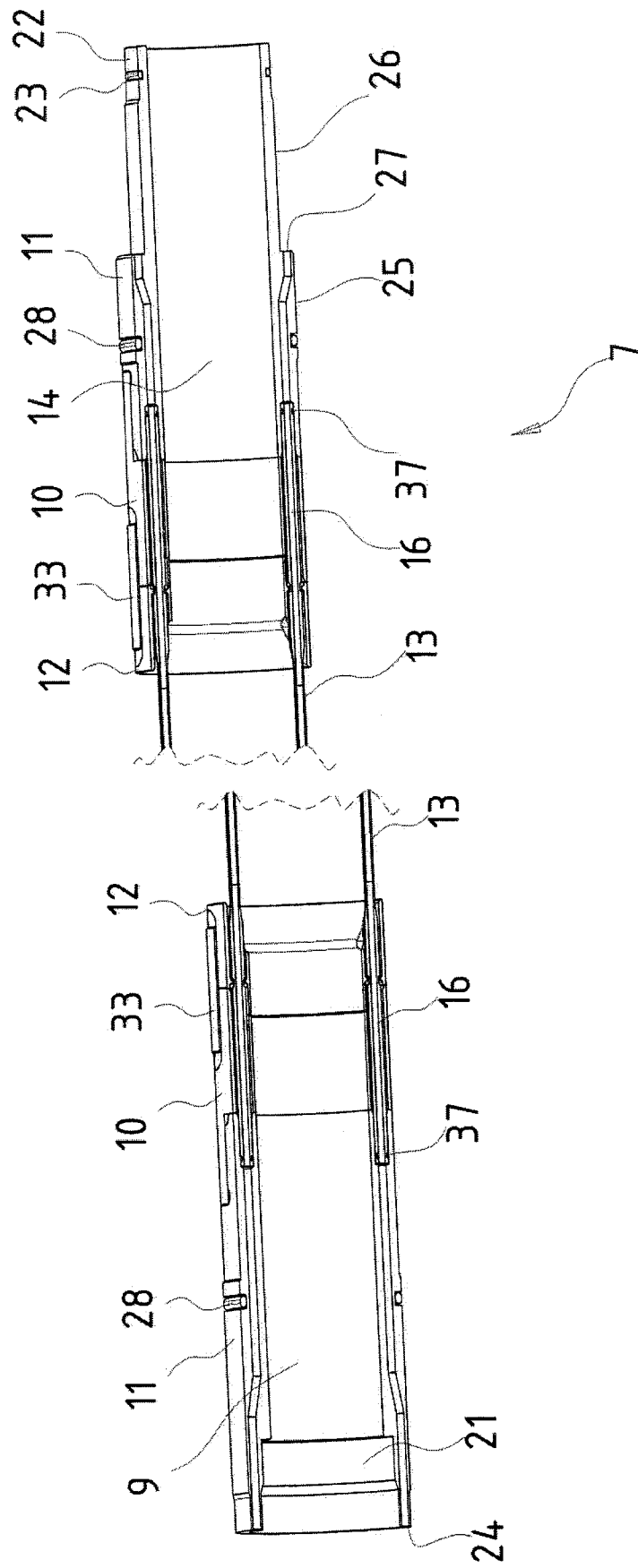


Fig. 3

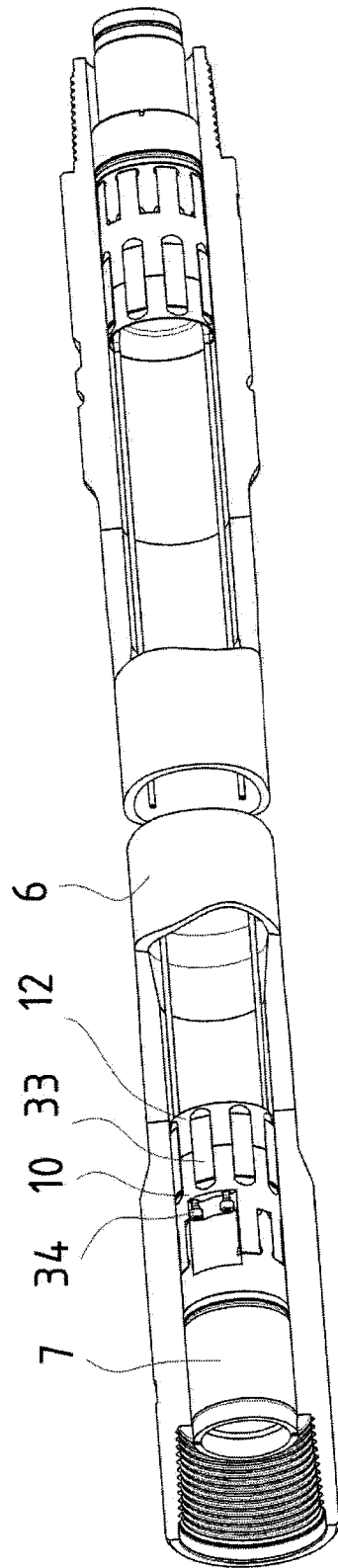


Fig. 4

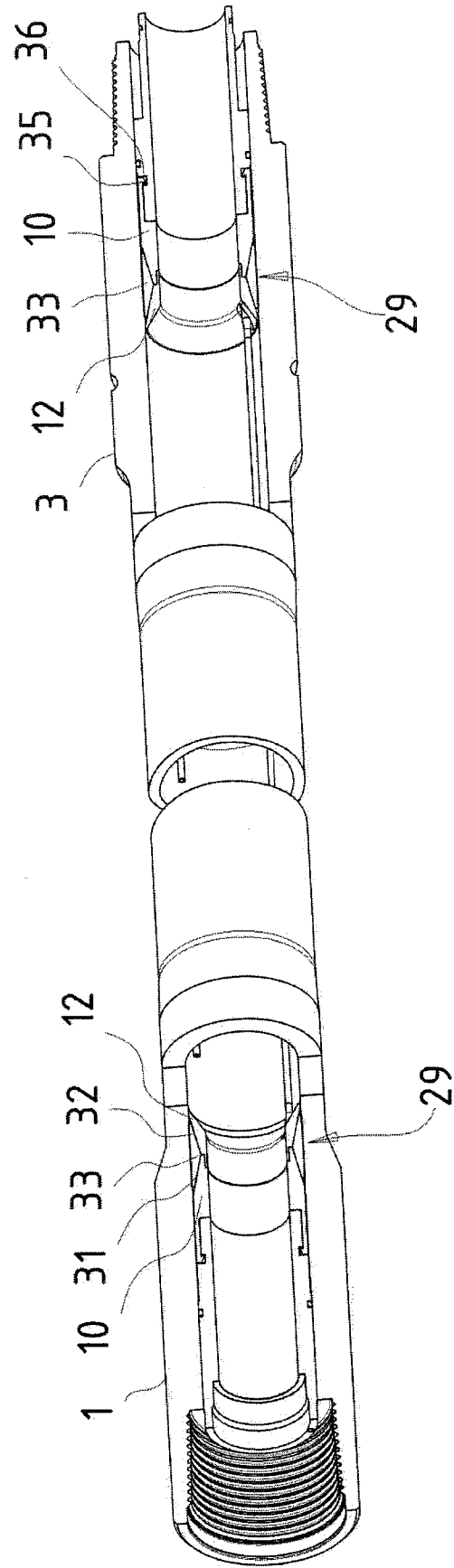


Fig. 5

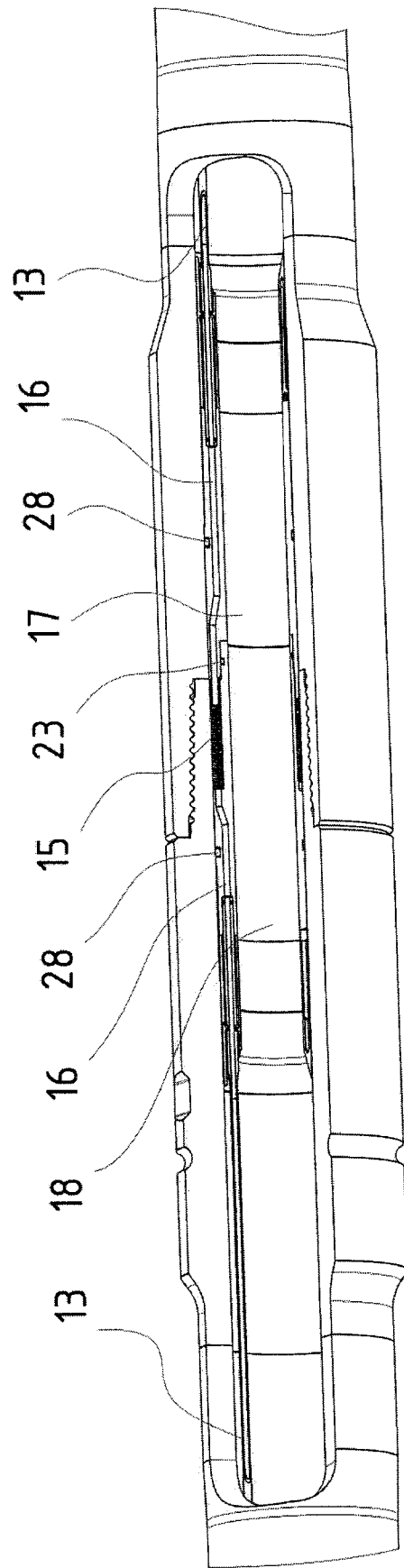


Fig. 6